

REMARKS

Claims 11-13 and 21 are canceled. Claims 2-4, 10, 19, 22, 25, 26, and 29 have been amended. The application now includes claims 1-10, 14-20, and 22-29.

Claim 2 was objected to as not further limiting claim 1. Claim 2 has been amended to require $m + n = 10$. Similarly, claim 3 has been amended to require $m + n$ ranges from 10 to 30. Support for these amendments can be found in paragraph [0025] of the printed application where it is noted that m and n each preferably range from 5 to about 15.

Claims 11-13 were canceled thereby making moot the rejection lodged under 35 U.S.C. 112, second paragraph.

Claim 19 is amended to include the same chemical structure as claim 1. This amendment addresses the objection lodged under 35 C.F.R. 1.75c. In addition, this amendment addresses the rejection lodged under 35 U.S.C. 112, second paragraph, in that it now depends from claim 10 and references the reacting step instead of using the "formed by" language.

The invention is directed to forming thermally and hydrolytically stable, flexible polymer exchange membranes (PEMs) with low methanol permeability and high proton conductivity, and producing these PEMs in an economically feasible manner (see paragraphs [0010], [0029], [0030], [0031], [0032], and [0033] of the printed application). The described PEMs have a hydrophobic segment that is fluorinated and a hydrophilic segment that is sulfonated (see paragraph [0015] of the printed application (see also paragraph [0012] which corresponds to claims 8 and 9)). Claims 4 has been amended to require that the hydrophobic segment is fluorinated and that the hydrophilic segment is sulfonated. This requirement is also specified in independent claims 10, 22, and 26. Further, the independent claims require that the hydrophobic segment contain a fluorinated aromatic. This is shown in the multiblock polymer of claims 1 and 19, and in the exemplary structure of paragraph [0024] (see also Figure 1 of the application). Furthermore, paragraph [0042] specifically references perfluoroaromatic monomers being used because they are highly reactive to they are highly reactive toward the nucleophilic aromatic substitution reaction. The materials contemplated by this invention also have a

co-continuous morphology of hydrophilic and hydrophobic segments. As explained in paragraph [0023] this means that the hydrophobic segments microphase separate (i.e., organize) from the hydrophilic segments. This makes the materials well suited for PEMs used in fuel cells (see also paragraphs [0026] and [0028]). Claims 4, 10 and 22 recite this feature.

Claims 4-7, 9-16, 18, 22, and 23 have been rejected as being anticipated by U.S. Patent Publication 2002/0091225 to McGrath. This rejection is traversed in view of the amendment above.

A text search of McGrath will demonstrate that while the concept of hydrophilic sulfonate groups in the polymer is discussed, nowhere is there any teaching or suggestion of having hydrophobic blocks or regions in McGrath. Furthermore, independent claims 4, 10, and 22 require a fluorinated hydrophobic segment or block to be present in combination with the sulfonated hydrophilic segment or block, and McGrath completely lacks this feature. As such, no claims are anticipated by McGrath.

Furthermore, it is noted that paragraph [0084] of McGrath refers to the humidity used when the material is analyzed with atomic force microscopy (e.g., rh = 35%). This has nothing to do with the mean humidity of the polymer.

In addition, with respect to paragraphs [0015] and [0016] of McGrath where one of the Z substitutions is identified as possibly including a fluorinated methyl, it is noted that the independent claims of the present invention require a fluorinated aromatic which is not shown in McGrath.

Finally, claim 4 requires that the copolymer have a co-continuous morphology of hydrophobic and hydrophilic segments. As McGrath lacks any teaching of hydrophobic blocks mixed with hydrophilic blocks, McGrath also lacks the co-continuous morphology requirement of claim 4 wherein fluorinated hydrophobic segments and sulfonated hydrophilic segments are together in a co-continuous morphology.

Claims 1-3 have been rejected as being obvious over McGrath in view of U.S. Patent 5,976,418 to Fuller. This rejection is traversed.

As is recognized in the office action, McGrath wholly lacks the perfluorinated hydrophobic blocks or segments. Fuller does not make up for this deficiency as suggested in the office action. Column 36 of Fuller only shows a polyarylene either

ketone which includes a fluorinated species. Fuller has no showing of a multiblock copolymer with both hydrophobic and hydrophilic species. Thus, it is simply incorrect to conclude that one of ordinary skill in the art would mix and match chemicals from McGrath and Fuller to come up with the claimed invention. In short, McGrath teaches a polymer which includes a hydrophilic disulfonated moiety and no teaching of using this in combination with a hydrophobic block or segment (much less a fluorinated hydrophobic block), and Fuller teaches a polymer that is perfluorinated and has no teaching of having a perflourinated segment in combination with another segment that is not perfluorinated (much less a hydrophobic segment or segment that is sulfonated). Note that both moieties of the column 36 polymers of Fuller are fluorinated). What is missing from the prior art is that having hydrophobic and hydrophilic segments in a multiblock polymer can have advantages in for PEMs. Further, what is missing from the prior art is having a fluorinated hydrophobic block in a multiblock copolymer together with a hydrophilic block. Claim 1 also sets forth a specific fluorinated hydrophobic block and a specific sulfonated hydrophilic block, and only the applicant put these blocks together to make the claimed invention. Therefore, none of the claims would be obvious over any combination of McGrath and Fuller.

Claims 8, 17, 20, 24, 25, 28 and 29 were rejected as being obvious over a combination of McGrath and WO 2003/030289 to Jacoby. This rejection is traversed.

As noted with respect to claim 4, McGrath wholly omits having a hydrophobic segment, and particularly a fluorinated hydrophobic segment, in combination with a sulfonated segment. In addition, McGrath also lacks the co-continuous morphology requirement of claim 4 wherein fluorinated hydrophobic segments and sulfonated hydrophilic segments are together in a co-continuous morphology. Finally, McGrath omits a fluorinated aromatic as part of the fluorinated hydrophobic block (while paragraphs [0015] and [0016] have been identified, it is noted that these passages pertain to the Z moiety between the phenyls and McGrath does not show the aromatic being fluorinated).

Jacoby does not make up for the deficiencies of McGrath. In particular, with respect to claim 3 of Jacoby (referenced in the office action), it is noted that this claim relates to a particular segment B (i.e., it does not pertain to having a perfluorinated

hydrophobic segment that is part of a multi block with another segment (e.g., a sulfonated hydrophilic segment). Moreover, claim 3 specifically references a perfluoro alkyl sulfone acid or a perfluoro alkyl carbonic acid process (among other processes). Thus, claim 3 does not teach combining hydrophobic segments and hydrophilic segments, and does not teach having a co-continuous morphology requirement of claim 4 wherein fluorinated hydrophobic segments and sulfonated hydrophilic segments are together in a co-continuous morphology. Further, Jacoby does not teach a fluorinated aromatic as part of the fluorinated hydrophobic segment, much less the use of a fluorinatated aromatic segment in combination with a hydrophilic segment (or a sulfonated hydrophilic segment). As such, no combination of Jacoby and McGrath would make any of the claims obvious to one of ordinary skill in the art.

Claim 21 has been rejected as being obvious over a combination of McGrath in view of U.S. Patent 4,638,039 to Percec. This rejection is moot in view of the cancelation; however, the applicant retains the right to pursue this claim or a substantially similar claim in a continuing application as the references do not show a step growth procedure for forming a PEM.

Claims 26 and 27 have been rejected as being obvious over McGrath in view of the Encyclopedia Britannica entry for fuel cells. This rejection is traversed in view of the amendments above.

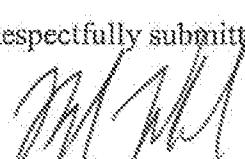
Claim 26 requires that the fuel cell include a multiblock copolymer with at least one fluorinated hydrophobic segment that includes a fluorinated aromatic and at least one sulfonated hydrophilic segment. As discussed in detail above, and as admitted by the Office Action, McGrath does not show a perfluorinated hydrophobic segment. Further, a text scan reveals McGrath does not describe a hydrophobic segment mixed with a hydrophilic segment. Further still, McGrath does not show a fluorinated aromatic (the passages in paragraphs [0015] and [0016] do not include a fluorinated aromatic). McGrath does not describe a cocontinuous morphology. The Encyclopedia Britannica lacks each and every one of the deficiencies of McGrath. Therefore, no combination of the two references would make the claimed invention obvious to one of ordinary skill in the art.

In view of the foregoing, it is respectfully requested that the application be reconsidered, that claims 1-10, 14-20, and 22-29 be allowed, and the application be passed to issue.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

A provisional petition is hereby made for any extension of time necessary for the continued pendency during the life of this application. Please charge any fees for such provisional petition and any deficiencies in fees and credit any overpayment of fees to Attorney's Deposit Account 50-2041.

Respectfully submitted,



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